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EXAMINER	
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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 09/072,959
Filing Date: May 05, 1998
Appellant(s): PAN, PAI HUNG

Brick G. Power
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 4/23/04 appealing from the office action mailed 6/22/05.

(1)Real Party in Interest

A statement identifying the real party in interest is contained in the brief.

(2)Related Appeals and Interferences

A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3)Status of Claims

The statement of the status of the claims contained in the brief is correct.

(4)Status of Amendments After Final

No amendment after final has been filed.

(5)Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

The following is a listing of the evidence (e.g., patents, publications, Official Notice, and admitted prior art) relied upon in the rejection of claims under appeal.

5,712,185	TSAI	1-1998
4,835,584	LANCASTER	5-1989

Lee, H.S., et al, "An Optimized Densification of the Filled Oxide for Quarter Micron Shallow Trench Isolation (STI)", 1996 IEEE Symposium on VLSI Technology Digest of Technical Papers (1996), pp.158-159

(10)Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1-4,11-14,16,25-27,33-35 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsai et al in view of Lancaster.

Tsai et al discloses in figures 3a-3h and the accompanying description formation of dielectric layer 32 and buffer layer 34 over semiconductor substrate 30, patterning of layers 32 and 34, trench etching using the patterned layers 32 and 34 as a trench mask, optional thermal oxidation of the trench walls through disclosure of "usually performed" (col.3, lines 35 and 36), selective isotropic etching of layer 34 and filling of the trench with silicon dioxide isolation material. Further, the references teaches as an alternative to the depicted process removal of layer 36A prior to deposition of the trench fill oxide (col.3, lines 33-34). In that embodiment the trench fill oxide would contact both the top major surface of the buffer layer 34 and the side surface of buffer layer 34. The reference discloses the purpose of the thermal oxidation of the trench walls to be "for relieving the defect resulting from the aforementioned etching process" which is removal of the nitride layer 34 (col.3, lines 33-37). The reference does not disclose forming the oxide layer before the etching of layer 34.

Lancaster discloses that in removal of a nitride trench etch mask material with phosphoric acid, which is the etchant used in the removal of the nitride layer in the process of Tsai et al (col.3, line 22), the silicon of the trench may be attacked by the etchant and it is helpful to form sacrificial oxide 52a on the trench surfaces prior to nitride material removal (col.3, lines 40-49).

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Lancaster with those of Tsai et al to protect the trench surfaces of Tsai et al during removal of the nitride layer 34 in the process of Tsai et al to further provide trench wall surfaces that are free from damage. The function of the sacrificial oxidation step of Tsai et al would in that event be obtained by protecting the trench wall surfaces as disclosed by Lancaster.

Claims 17 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsai et al in view of Lancaster as applied to claims 1-4,11-14,16,25-27,33-35 and 37 above, and further in view of the following comment.

Tsai et al discloses removal of 50-100 angstroms of buffer layer 34. In view of this disclosure, one of ordinary skill in the art would have been led to the recited amount of buffer layer 34 to be removed to achieve formation of desired device dimensions and resulting device characteristics on the finished wafer. Further, it would have been an obvious matter of design choice bounded by well known manufacturing constraints and ascertainable by routine experimentation and optimization to choose these particular dimensions because applicant has not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another dimension. Indeed, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, In re Rose, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); In re Rinehart, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225

USPQ 232 (1984); In re Dailey, 357 F.2d 669, 149 USPQ 47 (CCPA 1966). See also MPEP 2144.04(IV)(B).

Claims 5,15,28 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsai et al in view of Lancaster as applied to claims 1-4,11-14,16,25-27,33-35 and 37 above, and further in view of Lee et al.

Tsai et al does not disclose densification of the trench fill material. Lee et al discloses densification of trench fill material (abstract, for example). It would have been within the scope of one of ordinary skill in the art to combine the teachings of the Tsai et al and Lee et al to enable the trench fill material of Tsai et al to be densified according to the teachings of Lee et al that the method is intended for trench fill dielectrics and to obtain the benefit disclosed by Lee et al of reduced oxide consumption in subsequent process steps (p.158, col.1, lines 23-25).

(11)Response to Argument

Appellant argues that the teachings of Lancaster are not applicable to the teachings of Tsai et al because Lancaster is directed to transistor formation where Tsai et al is directed to formation of a trench isolation structure. However, the teachings of Lancaster related to nitride material removal are applicable to the process of removing nitride material as disclosed by Tsai et al. The additional teachings related to gate formation in the process of Lancaster do not negate those relied on. Further, the teachings relied on would not be expected to depend on performing the additional teachings pointed to by appellant.

Appellant argues that if it was obvious to one of ordinary skill in the art that the teachings of Lancaster were applicable to the teachings of Tsai et al the teachings of Lancaster related to liner oxide

formation would be contained in the disclosure of Tsai et al. However, this argument would appear to obviate any rejections under 35 USC § 103 and is therefor on it's face invalid. There is no requirement that each reference in a rejection under 35 USC § 103 contain reference to the teachings in the other references used in the rejection. In response to appellant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Appellant argues that the teachings of Lancaster are not applicable to the process of Tsai et al because less nitride material is removed in the process of Tsai et al and the problem of removal of silicon from the trenches would not occur. However, the problem of removal of silicon from the trenches would occur in both processes because in both processes phosphoric acid is used to remove nitride material in the presence of exposed silicon material indicating to one of ordinary skill in the art that there would be a reasonable expectation of success when applying the teachings of Lancaster to the process of Tsai et al and that removal of silicon from the trenches would be prevented thereby.

Appellant argues that Tsai et al discloses an oxidation step that would render the oxidation step according to the teachings of Lancaster unnecessary. However, Tsai et al discloses the step as optional through use of "usually performed" (col.3, lines 35 and 36). Tsai et al also discloses that the purpose of the sacrificial oxidation is to relieve the defect resulting from the removal of the nitride material (col.3, line 36). In the process of the combination the step of Lancaster would have been expected by one of ordinary skill in the art to protect the trenches during the etching as disclosed by Lancaster and to prevent the defect formation disclosed by Tsai et al rendering the sacrificial oxidation step of Tsai et al unnecessary.

Appellant argues that Lancaster teaches away from the combination because Lancaster teaches complete removal of the nitride layer and gate formation. However, these additional teachings pointed to by appellant are not relied upon in the rejection and do not negate the teachings relied upon in the rejection related to protection of silicon trench surfaces during nitride material removal.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

George Fourson
Primary Examiner
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January 20, 2006

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